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Method and Apparatus for Heating a Roller

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] The present application is the National Stage Application of International Application No. PCT/EP2005/050258, filed January 21, 2005, which claims priority to DE 10 2004 006 515.2, filed on February 10, 2004.

BACKGROUND OF THE INVENTION

[0002] ~~This~~ The present invention relates to a method and apparatus for heating a roller used in the production and/or finishing of a web, ~~of material,~~ particularly a paper web or paperboard web.

[0003] The ~~object of the~~ present invention ~~is to create~~ creates an improved method and apparatus ~~of the type initially referred to.~~ ~~In particular the use of~~ by use of renewable fuels. ~~should also be possible.~~

[0004] ~~This object is accomplished in accordance with the invention in that~~ In various embodiments, the roller is heated from the outside by a heated gas. ~~In this case the~~ The ~~heat~~ heated gas ~~is~~ can be generated ~~preferably~~ by ~~means of~~ at least one burner arranged near ~~the~~ a surface of the roller

~~surface~~. The ~~heat~~ heated gas emerging from the burner can then act on the surface of the rotating roller.

[0005] Hence, the heat is generated near the location of the roller ~~where it is required~~. Furthermore, renewable ~~energies~~ fuels can ~~now~~ be used to generate ~~the~~ required heat ~~required~~.

SUMMARY OF THE INVENTION

[0006] According to various ~~a preferred practical~~ embodiments ~~of the method~~ ~~according to the~~ of the present invention,~~, the roller is heatable on a zone basis viewed in the direction of the roller axis, with the various zones being heatable independently of each other at least in part. As such, differentiation across the width of the respective web is also possible if required.~~ axial heat zones can be used to achieve distinct axial temperatures along the roller. The distinct axial temperatures can be transferred to the web during production and/or finishing.

[0007] For example, ~~provision can be made for~~ several burners can be distributed over the length of the roller.

[0008] According to various ~~an advantageous practical~~ embodiments of ~~the method according to~~ the present invention, the burner used is a catalytic burner by ~~means~~ ~~of~~ which the ~~heat~~ heated gas is generated through combustion of a fuel with air or oxygen.

[0009] A burner can thus comprise, for example, a carrier with a catalytic coating.

[0010] The fuel used can be ~~particularly~~ a fuel gas. Hence the burner can be fed, for example, with an ~~in particular~~ adjustable fuel gas/air mixture. In this case, preferably fuel and air are fed to a mixing element upstream from the respective burner.

[0011] ~~Preferably~~ In one exemplary embodiment, supplied air is distributed by an air distributor among several burners.

[0012] The reaction or roller temperature ~~is~~ can be set or controlled ~~preferably~~ by ~~means of~~ the fuel/air mass flow ratio.

[0013] For example, the fuel gas mass flow and/or the fuel gas concentration in the air can be controlled for each axial heat zone. ~~The control in question is performed preferably on a zone basis~~.

[0014] ~~The~~ In an exemplary embodiment, the fuel used can be~~, for example,~~ hydrogen, hydrogen-rich gas (reformat) or natural gas.

[0015] According to another ~~advantageous~~ embodiment of ~~the method according to~~ the invention, a respective burner is arranged in an air-moving chamber and the air flowing over the burner is mixed with the burner waste gas. In this case the air flowing over the burner can be expediently mixed with the waste gas from the burner by ~~means of~~ a mixing element. The mixing element may be located near a terminus of the air moving chamber.

The terminus of the air moving chamber may be adjacent the roller. ~~in the region of the end of the air-moving chamber facing the roller.~~

[0016] In this case the air flowing over the burner can be heated by ~~said~~ the burner. ~~It is also conceivable, however, for~~ In another exemplary embodiment, the burner ~~to~~ may work adiabatically, meaning that there is no transfer of heat to the "bypass flow". The cold bypass flow is then mixed with the hot burner waste gas, resulting downstream from the mixing element in a mixture with ~~an adequate~~ a desired temperature.

[0017] Such an embodiment ~~makes sense in particular~~ may be advantageous when using a fuel that reacts with air only at high temperatures. Natural gas, for example, does not react fully with air until ~~in~~ it reaches a higher temperature range of ~~(~~600°C – 800°C~~)~~.

[0018] The hot gas temperatures ~~would~~ may be too high for the roller surface. Therefore, the hot gas is mixed with the "cold" bypass flow.

[0019] According to another ~~advantageous~~ embodiment of ~~the method according~~ ~~to~~ the present invention, heated gas generated by ~~means of a~~ the burner is mixed with supplied cold air in at least one mixing element ~~in order to generate the heat gas for acting on the roller~~. In this case it is advantageous for the mass flow of the cold air supplied to the mixing element to be adjustable or controllable. Again, the burner is preferably supplied with air and fuel, particularly fuel gas. The fuel gas ~~used in this case~~ can be natural gas ~~for example~~.

[0020] In one exemplary embodiment, ~~The~~ ~~hot~~ heated gas generated by ~~means of~~ the burner ~~is preferably~~ can be distributed by a gas distributor among several mixing elements that are ~~distributed~~ arranged over the length of the roller. The mass flows of cold air supplied to the various mixing elements ~~are preferably~~ can be individually adjustable or controllable ~~at least in part~~.

[0021] ~~Again, differentiation across the web width is thus possible in the latter case too.~~ As stated previously, axial heat zones may be used to achieve distinct axial temperatures along the roller.

[0022] According to one apsect of the invention, a method for heating a roller is provided, the method including: heating a first gas in a first axial zone; directing the first gas toward the roller to achieve a first surface temperature; heating a second gas in a second axial zone; and directing the second gas toward the roller to achieve a second surface temperature, wherein the first axial zone and the second axial zone are located exterior to the roller and along distinct axial locations adjacent the roller. The first gas can be produced by a fuel supplied to a burner. The first surface temperature can be distinct from the second surface temperature. The method can include heating a third gas in a third axial zone; and directing the third gas toward the roller to achieve a third surface temperature. The burner can include one of a catalytic burner or a carrier having a catalytic coating. The fuel can be a fuel gas. The fuel gas to air ratio can be adjustable. The fuel gas and air can enter a mixing element prior to entering the burner. An air distributor can supply air for at least the first and second axial zones.

The fuel gas can have a variable mass flow rate. The fuel gas can include one of hydrogen or natural gas. The first gas can include an output from the burner and burner waste gas. The output from the burner can be combined in a mixing element with the burner waste gas. The first gas can be mixed in a mixing element with a first air input to produce a first heat gas. The first air input can be variable. The gas distributor can direct the first heat gas through a first axial mixing element.

[0023] According to another aspect of the invention, an apparatus for heating a roller is provided, the apparatus including: a first axial zone for heating a first gas; a first exit zone defining a portion of the first axial zone; a second axial zone for heating a second gas; and a second exit zone defining a portion of the second axial zone, wherein the first and second exit zones are located exterior to the roller and define distinct axial locations along the roller. The apparatus can further include a first burner for producing the first gas, whereby fuel is input to the first burner. The apparatus can further include at least one of an adjustable fuel to air ratio, a mixing element for the fuel and air, and an air distributor for supplying air to the burner.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] The present invention will be described in more detail in the following text using exemplary embodiments and with reference to the drawing, in which:

[0025] F~~f~~igure 1 ~~is a schematic representation~~ illustrates one exemplary embodiment of a device for heating a roller with several catalytic burners that

are arranged in succession in the direction of the roller axis ~~and enable differentiation,~~.

[0026] F~~f~~igure 2 ~~is a schematic representation of~~ illustrates another embodiment of the heating device in which the catalytic burners are arranged in each ~~case~~ axial heat zone in an air-moving chamber and the air heated by a respective burner is used to generate the ~~heat~~ heated gas which acts on the roller~~, and.~~

[0027] F~~f~~igure 3 ~~is a schematic representation of~~ illustrates another embodiment in which the ~~hot~~ heated gas generated by ~~means of~~ a gas burner is distributed by a gas distributor among several mixing elements, located ~~that are~~ ~~distributed~~ over the axial length of the roller, and ~~are~~ fed ~~in addition~~ with cold air, whereby the mass flows of cold air supplied to the various mixing elements are ~~separately~~ individually adjustable or controllable.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0028] Figure 1 ~~shows in a schematic representation~~ illustrates an embodiment of a device 10 for heating a roller 12 ~~that is used in particular~~ for producing and/or finishing a web of material, particularly a paper web or paperboard web.

[0029] The roller 12 can be heated from the outside by ~~means of~~ the device 10 using a heated gas 14. For this purpose the device 10 comprises several burners 18 which are distributed over the length of the roller 12 and arranged near the roller surface 16.

[0030] The ~~heat~~ heated gas 14 emerging from the burners 18 acts ~~accordingly~~ on the surface 16 of the ~~rotating~~ roller 12.

[0031] ~~In this case~~ According to an exemplary embodiment, the roller 12 is heatable on a zone basis in the direction of the roller axis, thus enabling differentiation in the transverse direction of the web, meaning transverse to the running direction of the web. Axial heat zones can be used to achieve distinct axial temperatures along the roller 12. The distinct axial temperatures can be transferred to the web during production and/or finishing.

[0032] ~~In the case under consideration~~ According to an exemplary embodiment, the burners 18 are catalytic burners ~~by means of which the heat gas~~ for heating the gas 14 ~~is~~ generated through combustion of a fuel 20 with air 22 or oxygen.

[0033] Hence the burners 18 can each comprise a carrier 24 with a catalytic coating.

[0034] The fuel 20 provided can be ~~in particular a fuel gas such as,~~ for example, hydrogen (H_2) or hydrogen-rich gas (reformat). ~~In principle, fuels other than hydrogen are also conceivable however.~~ Other fuels can also be used within the scope of the present invention.

[0035] An adjustable fuel gas/air mixture is fed in each case to the various catalytic burners 18. In this case a mixing element 26, to which fuel 20 and air 22 are fed, is installed ~~respectively~~ upstream from the burners 18.

[0036] ~~Also, provision is made for~~ In one exemplary embodiment, an air distributor 28 ~~by means of which~~ distributes supplied air 22 ~~is distributed~~ among the various catalytic burners 18.

[0037] ~~In the case under consideration the reaction or~~ In one exemplary embodiment, the roller temperature is adjustable or controllable ~~on a zone basis by means of the respective~~ within axial zones by adjusting individual fuel/air mass flow ~~ratio~~ ratios. ~~For this purpose provision~~ Provisions can be made, for example, for controlling the respective fuel gas mass flow and/or the respective fuel gas concentration in the air.

[0038] The control or adjustment ~~in question~~ can be performed ~~on a zone basis~~ within axial zones. In the ~~case under consideration~~ present exemplary embodiment, control valves 32 are provided for this purpose in the various fuel supply lines 30 to the various mixing elements 26.

[0039] The various catalytic burners 18 are arranged ~~respectively~~ in a chamber 32 in which provision is also made ~~respectively~~ for the mixing element 26 ~~that is~~ installed upstream from the burner 18 ~~in question~~. Using ~~these~~ chambers 32, heating gas 14 can be made to ~~act~~ yield distinct temperature zones on the roller 12 ~~on a zone basis~~.

[0040] ~~The~~ Another exemplary embodiment of the heating device 10 presented in figure 2 differs from ~~the one in~~ figure 1 ~~firstly~~ in that the various catalytic burners 18 are arranged respectively in an air-moving chamber 34. ~~and the~~ The air flowing over the burners 18 for generating the ~~heat~~ heated gas 14 for acting on the roller 12 is mixed with the burner waste gas.

[0041] In this case the air flowing over the burner 18 can be heated by ~~said~~ the burner 18. It is also conceivable, however, for the burner to work adiabatically, meaning that there is no transfer of heat to the "bypass flow". The cold bypass flow is then mixed with the hot burner waste gas, resulting downstream from the mixing element in a mixture with ~~an adequate~~ a desired temperature. Such an embodiment ~~makes sense in~~ ~~particular~~ is beneficial when using a fuel that reacts with air only at high temperatures. Natural gas, for example, does not react fully with air until ~~in a high~~ until it reaches a temperature range ~~(~~600°C – 800°C~~)~~. The hot gas temperatures ~~would~~ may be too high for the roller surface. Therefore, the hot gas is mixed with the "cold" bypass flow.

[0042] According to this exemplary embodiment, the mixing element 36 can be located near a terminus of the air moving chamber 34, whereby the terminus of the air moving chamber 34 is adjacent roller 12. ~~In this case provision is made in a respective air-moving chamber 34 in the region of its end facing the roller 12 for a mixing element 36 by means of which the air~~ Air flowing over and heated by the catalytic burner 18 is mixed with the waste gas from the burner 18. The ~~hot~~ heated air emerging from the mixing elements 36 then acts ~~accordingly~~ on the roller 12.

[0043] Again, a mixing element 26 is installed respectively upstream from the catalytic burners 18 in order to generate the mixture of fuel and air supplied to the respective burner 18.

[0044] According to one exemplary embodiment, natural ~~Natural~~ gas can be ~~, for example, is~~ provided as fuel 20 ~~in the case under consideration~~.

[0045] ~~Otherwise, this embodiment again has at least substantially the same construction as the one in figure 1, mutually corresponding parts being assigned the same reference symbols. Again,~~ Temperature differentiation across the web width is possible according to the present exemplary embodiment ~~accordingly in the present case too~~.

[0046] Figure 3 illustrates ~~shows a schematic representation of~~ a further exemplary embodiment of the device 10.

[0047] In the ~~case under consideration~~ present exemplary embodiment, the hot gas 40 generated by ~~means of~~ a gas burner 38 is distributed by a gas distributor 42 among several mixing elements 44 that are distributed over the length of the roller 12 and each supplied ~~separately~~ individually with cold air 46. The mass flows of cold air 46 supplied to the various mixing elements 44 are ~~therefore~~ adjustable or controllable for each distinct temperature zone ~~on a zone basis~~. ~~In the case under consideration, throttle~~ Throttle valves 50 are provided ~~for this purpose~~ in the various fuel supply lines 48 to the various mixing elements 44.

[0048] The hot gas 40 supplied by the gas burner 38 is mixed with the cold air supplied through the cold air supply line 48 ~~in question by means of the~~ to the mixing elements 44, ~~which again are~~ arranged in a chamber 52, ~~in order~~ to generate the hot air 14 ~~in question~~ for acting on the roller 12.

[0049] As ~~is~~ evident in figure 2, a fuel gas 54, in this case natural gas for example, and air 56 are fed to the burner 38.

[0050] ~~Again, the~~ The mass flows of cold air supplied to the various mixing elements 44 are adjustable or controllable ~~on a zone basis by means of the~~ via the throttle valves 50. ~~Differentiation~~ Temperature differentiation in the transverse direction of the web is ~~thus~~ also possible ~~in this case too~~.

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[0051] **List of reference numerals**

10	Heating device
12	Roller
14	Heated gas, heat gas
16	Roller surface
18	Catalytic burner
20	Fuel
22	Air
24	Catalytic carrier with catalytic coating
26	Mixing element
28	Air distributor
30	Fuel supply line
32	Chamber
34	Air-moving chamber
36	Mixing element
38	Gas burner
40	Hot gas
42	Gas distributor
44	Mixing element
46	Cold air
48	Cold air supply line
50	Throttle valve
52	Chamber

54	Fuel gas
56	Air
X	Roller axis